

## Infection related to the external ventricular shunt in a neurosurgery hospital

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RESEARCH

INFECTION RELATED TO THE EXTERNAL VENTRICULAR SHUNT IN A NEUROSURGERY HOSPITAL  
INFECÇÃO RELACIONADA À DERIVAÇÃO VENTRICULAR EXTERNA EM HOSPITAL DE NEUROCIRURGIA  
INFECCIÓN RELACIONADA CON DERIVACIÓN VENTRICULAR EXTERNA EN HOSPITAL DE NEUROCIRUGÍA

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ABSTRACT

**Objective:** Identify the factors co-responsible for infection related to external ventricular shunt (EVS). **Method:** This is a retrospective study with quantitative data analysis developed at the Medical Archive Service of a public hospital which is a reference in neurosurgery in Pernambuco, Brazil. The sample consisted of 140 patients who underwent the insertion of external ventricular shunt. Data were collected through a semi-structured questionnaire and analyzed using the software *Statistical Package for the Social Sciences (SPSS)*, version 13.0. **Results:** Predominance of males (39.7%); age between 20 and 39 years (52%); length of hospital stay over 60 days (72.7%); multiple EVS placed (100%); length of EVS use over 30 days (96.2%). **Conclusion:** Statistical significance for the factors: prolonged length of hospital stay; number of EVS placed; length of EVS use; and the development of infection. Nursing actions are emerging and they're aimed at ensuring patient safety in the hospital environment. **Descriptors:** Infection, Nursing care, Risk factors, cerebrospinal fluid shunts.

RESUMO

**Objetivo:** Identificar os fatores corresponsáveis de infecção relacionada à derivação ventricular externa (DVE). **Método:** Trata-se de estudo retrospectivo com análise quantitativa dos dados desenvolvido no Serviço de Arquivo Médico de um hospital público que é referência em neurocirurgia em Pernambuco. A amostra foi constituída por 140 pacientes submetidos a inserção de derivação ventricular externa. Os dados foram coletados por meio de um questionário semiestruturado e analisados com o programa *Statistical Package for the Social Sciences (SPSS)*, versão 13.0. **Resultados:** Predominância do sexo masculino (39,7%); idade entre 20 e 39 anos (52%); tempo de internamento acima de 60 dias (72,7%); múltiplas DVEs colocadas (100%); tempo de uso da DVE acima de 30 dias (96,2%). **Conclusão:** Significância estatística para os fatores: tempo de internação prolongado; número de DVEs colocadas; tempo de uso da DVE; e o desenvolvimento de infecção. As ações de enfermagem são emergentes e visam a garantir a segurança do paciente no ambiente hospitalar. **Descritores:** Infecção, Cuidados de enfermagem, Fatores de risco, Derivações do líquido cefalorraquidiano.

RESUMEN

**Objetivo:** Identificar los factores co-responsables de infección relacionada con la derivación ventricular externa (DVE). **Método:** Esto es un estudio retrospectivo con análisis cuantitativo de datos desarrollado en el Servicio de Archivo Médico de un hospital público que es referencia en neurocirugía en Pernambuco, Brasil. La muestra consistió de 140 pacientes que se sometieron a inserción de una derivación ventricular externa. Los datos fueron recogidos por medio de un cuestionario semi-estructurado y analizados con el programa *Statistical Package for the Social Sciences (SPSS)*, versión 13.0. **Resultados:** Predominio del sexo masculino (39,7%); edad entre 20 y 39 años (52%); tiempo de hospitalización mayor que 60 días (72,7%); múltiples DVEs colocadas (100%); tiempo de utilización de la DVE mayor que 30 días (96,2%). **Conclusión:** Significancia estadística para los factores: tiempo prolongado de hospitalización; número de DVEs colocadas; tiempo de utilización de la DVE; y el desarrollo de infección. Las acciones de enfermería están surgiendo y tienen el fin de garantizar la seguridad del paciente en el entorno hospitalario. **Descriptor:** Infección, Atención de enfermería, Factores de riesgo, Derivaciones del líquido cefalorraquídeo.

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INTRODUCTION

External ventricular shunts (EVS) are crucial catheters for the neurosurgical treatment of patients with intracranial hypertension (ICH). Besides helping to measure intracranial pressure (ICP), they act in ICH treatment through cerebrospinal fluid drainage.<sup>1</sup>

EVS is often needed for treating emergencies in patients with fluid circulation disorders, subarachnoid hemorrhage, either intraventricular or intraparenchymal. ICP monitoring and concomitant cerebrospinal fluid (CSF) drainage have been more frequently reported in recent years.<sup>2</sup> However, the indication of EVS should be careful because of the complications in this kind of system, which are: infection at the catheter insertion site; meningitis, encephalitis, and ventriculitis; and, finally, intracerebral or intraventricular hemorrhages. Among these the most serious and commonly observed are central infections.<sup>3</sup>

Infections of the central nervous system determine a 10% to 20% increase in mortality of neurosurgical patients; increasing the morbidity rate and consequent increase in the length of hospital stay and hospital expenses.<sup>3</sup>

Given the high infection rates in the surgical procedures of cerebrospinal fluid drainage in our healthcare practice and knowledge on the current problems in any neurosurgery center, this study aimed to: identify the factors co-responsible for infection related to external ventricular shunt.

METHODOLOGY

This is a retrospective, descriptive, and exploratory study with quantitative data analysis. The research was conducted at the Medical Archive Service (MEAS) of Hospital da Restauracao (HR), a reference in neurosurgery in Pernambuco,

Brazil. Data collection was performed after assessment and approval by the Research Ethics Committee of the selected institution (CAAE 0027.0.102.000-09). Due to the use of secondary data, there was no need for signing of the consent form.

The sample consisted of 140 patients who underwent the surgery for insertion of external ventricular drainage catheter. Data were collected by analyzing the medical records filed in MEAS within the period from January 2006 to December 2008, with the completion of a semi-structured questionnaire developed by the authors.

For data analysis, one used descriptive statistics techniques through absolute and percentage distributions and statistical measures: mean, median, standard deviation, variation coefficient, minimum and maximum values, and inferential statistical techniques through the Pearson's square or Fisher's exact test, when the conditions for using the chi-square test weren't observed. The margin of error in the decision of statistical tests was 5.0%.

The software used for data entry and for obtaining the statistical calculations was the *Statistical Package for the Social Sciences (SPSS)*, version 13.0.

RESULTS AND DISCUSSION

One obtained a total of 140 patients who underwent the insertion of EVS. The infection was found out after CSF culture. One emphasizes that, out of these, 5 cultures were inconclusive.

Table 1 displays the occurrence of EVS infection according to age group, where one finds 52% of infection between 20 and 39 years, 51.7% up to 19 years, 43.2% between 40 and 59 years, and 18.6% aged 60 years or over. One highlights as a risk factor for developing infection ( $p = 0.009$ ).

Regarding sex, 39.7% of the occurrence of infection was related to being male and 38.9% to being female; no statistical difference was found ( $p = 0.92$ ).

Table 1 - Evaluation of the occurrence of infection according to age group and sex of patients with EVS in a public hospital. Recife, Pernambuco, Brazil.

Infection								
Variable	Yes		No		TOTAL		P value	OR (CI = 95%)
	N	%	n	%	N	%		
• Age group								
Up to 19 years	15	51.7	14	48.3	29	100.0	p <sup>(1)</sup> = 0.009 <sup>a</sup>	4.69 (1.63 to 13.5)
20 to 39 years	13	52.0	12	48.0	25	100.0		4.74 (1.58 to 14.2)
40 to 59 years	16	43.2	21	56.8	37	100.0		3.33 (1.22 to 9.12)
> 60 years	8	18.6	35	81.4	43	100.0		1.00
Total group <sup>(4)</sup>	52	38.8	82	61.2	134	100.0		
• Sex								
Male	25	39.7	38	60.3	63	100.0	p <sup>(1)</sup> = 0.925	1.03 (0.52 to 2.07)
Female	28	38.9	44	61.1	72	100.0		1.00
Total group	53	39.3	82	60.7	135	100.0		

- (\*): Significant difference at 5.0%.
- (1): By means of Pearson's chi-square test.
- (2): This information isn't available with regard to 1 respondent.

Regarding the occurrence of infection in patients with EVS, one highlights, in Table 2, that for 40.6% of the sample the indication for placing EVS was elective and for 32.4% it involves urgency. This doesn't reveal a risk factor for developing an infection ( $p = 0.08$ ).

In turn, with regard to the length of hospital stay over 60 days one obtained 72.3% of infection; 61.5% from 31 to 60 days; 40% from 16 to 30 days; and 7.5% up to 15 days. The placement of multiple EVS corresponded to 100% of infection and single EVS corresponded to 21.5%. Regarding the length of EVS use, infection was found over 30 days in 96.2%; from 16 to 30 days in 66.7%; and up to 15 days in 14.9%. Data presented above indicate statistical significance at  $p < 0.01$ .

One observes that death among these patients with EVS and infection corresponded to 32.3% of the sample, representing  $p < 0.02$ .

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Table 2 - Distribution of patients with EVS and the occurrence of infection according to the indication of placement, length of hospital stay, number of placements, and length of EVS use; and death in a public hospital. Recife, Pernambuco, Brazil.

Variable	Infection				TOTAL	P value	OR (CI = 95%)
	Yes n	%	No n	%	n		
• Indication of EVS placement							
Elective	30	46.9	34	53.1	64	100.0	p <sup>(1)</sup> = 0.085 1.84 (0.92 to 3.70) 1.00
Urgency	23	32.4	48	67.6	71	100.0	
Total group	53	39.3	82	60.7	135	100.0	
• Length of hospital stay (days)							
Up to 15	4	7.3	51	92.7	55	100.0	p <sup>(1)</sup> < 0.001 <sup>+</sup> *** *** *** ***
16 to 30	8	40.0	12	60.0	20	100.0	
31 to 60	16	61.5	10	38.5	26	100.0	
> 60	24	72.7	9	27.3	33	100.0	
Total group <sup>(2)</sup>	52	38.8	82	61.2	134	100.0	
• Number of EVS placed							
Single	22	21.2	82	78.8	104	100.0	p <sup>(1)</sup> < 0.001 <sup>+</sup> **
Multiple	30	100.0	-	-	30	100.0	
Total group <sup>(2)</sup>	52	38.8	82	61.2	134	100.0	
• Length of EVS use (days)							
Up to 15	13	14.9	74	85.1	87	100.0	p <sup>(1)</sup> < 0.001 <sup>+</sup> 1.00 *** **
16 to 30	14	66.7	7	33.3	21	100.0	
> 30	25	96.2	1	3.8	26	100.0	
Total group <sup>(2)</sup>	52	38.8	82	61.2	134	100.0	

- (\*) : Significant difference at 5.0%.
- (\*\*): It wasn't determined due to the occurrence of very low frequencies.
- (\*\*\*): It wasn't determined due to the occurrence of a very large interval.

- (1): By means of Pearson's chi-square test.
- (2): This information isn't available with regard to 1 respondent.

The diagnosis for EVS insertion and the development of infection were displayed in Table 3. Subarachnoid hypertension represented 38.1% of infections; hemorrhagic stroke accounted for 19.4%; hydrocephalus corresponded to 40%; and brain tumor corresponded to 47.7%.

Age was highlighted as a risk factor for the development of infection in patients with EVS; however, studies show no relationship between age, sex, and infection<sup>4</sup>; this contradicts the findings of this study.

Although the difference between urgent or elective EVS placement has no statistical relevance



for infection, studies reveal that low infection levels are related to the technique of catheter insertion. First, there's use of intravenous antibiotics before the procedure. The standard technique for skin preparation involves brushing and applying the PVPI solution with spontaneous drying to obtain an increased antimicrobial effect; tunneling of EVS catheter; and use of closed drainage and monitoring system which can reduce the contamination risk. Finally, there're daily dressing changes and local wound care for the skin can decrease the bacterial flora in the catheter insertion site.<sup>4</sup>

The length of hospital stay and the emergence of infection behaved as an important factor. One observes that periodical handling of the system by professionals participating in the health team without proper training could be a probable reason for the increased infection rates related to the length of hospital stay.<sup>5,6</sup>

The length of hospital stay and multiple insertion of EVS predisposes to the development of infections related to the shunt, something which may occur due to increased handling, predisposition to catheter colonization and the drainage system. The longer the length of hospital stay, the higher the risk for meningitis and/or ventriculitis.<sup>7</sup>

There're theories indicating periodical and the programmed replacement of shunt, regardless of the presence of infection.<sup>8</sup> However, in 2002, this practice was criticized, demonstrating that the elective EVS review doesn't produce any kind of benefit to the patient and that such a procedure, although not statistically significant, resulted in a higher infection rate.<sup>9</sup> A more recent study in this domain proves that elective replacement of the catheter significantly increases infection rates in patients, constituting a procedure and a routine not indicated.<sup>10</sup>

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CONCLUSION

The length of hospital stay; the number of placements; and the permanence of EVS statistically represented risk factors for infection in patients with EVS.

The limitations of this study were associated to failures of notes and information in the medical records, which may mask the actual results of the institution, but also the dearth of literature on the theme. Certainly, this study contributes to the knowledge and analysis of factors for infections related to EVS, besides the reflection on the quality of care provided by the nursing team in the intervention and prevention of this condition. One suggests the preparation of a protocol of nursing care for the patient with EVS, aiming to standardize the actions to be taken with shunt, thus ensuring assistance with greater patient safety in the hospital environment.

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